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Vertiports: Ready for Take-off … And Landing

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VERTIPORTS: READY FOR TAKEOFF . . . AND LANDING

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ABSTRACT

While aviation has been used in transportation for decades, the use of vertical takeoff and landing (VTOL) aircraft for large-scale, low-cost, green, sustainable, and integrated mobility in populated areas is a new phenomenon. Despite the importance of ground infrastructure for embarkation and disembarkation of passengers, cargo, and mail, questions remain on how these "vertiports" are or should be regulated and how they will relate to existing regulated ground infrastructure such as aerodromes, airports, and heliports. Therefore, several questions arise: what is a vertiport; how do vertiports relate to other aviation infrastructure; what are the legal implications of having different terms; what laws apply to vertiports? This Article seeks to address these questions from a European Union (EU) perspective by looking at the rise of civil VTOL aircraft and the need for vertiports. Following this, the Article analyzes the current and proposed legal landscapes in the EU. This analysis shows how vertiports are currently regulated and highlights the steps that still need to be taken. An examination of the different terms that exist and their definitions is also undertaken. This highlights the similarities and differences that exist between the different terms, thus allowing the relevant laws to be appropriately identified and their scope understood. Finally, the Article looks at some of the legal consequences of introducing the term "vertiport" by focusing on specific EU aviation-based regulations. Thus, this shows the real-life implications of the questions posed.

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TABLE OF CONTENTS

I. INTRODUCTION

A. A Brief History

WHILE THE AVIATION COMMUNITY is now giving significant attention to new mobility solutions that utilize the third dimension (i.e., the air), the concept of a machine capable of vertical takeoff and landing (VTOL) is not novel, as demonstrated by Leonardo da Vinci's fifteenth century sketches of an aerial screw, which can be seen as a prototype rotorcraft.[1] However, it was only with recent technological advancements, which began at the dawn of the twentieth century, that da Vinci's vision could be actualized.[2]

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[1] *Helicopter*, Leonardo da Vinci, https://www.leonardo-da-vinci.net/helicopter/ [https://perma.cc/DTV7-4LMU]; *see* discussion *infra* Section III.B.3 for more information about rotorcraft.
[2] *See id.*

In 1907, French brothers Jacques and Louis Breguest made the first attempt to build a working VTOL aircraft.[3] The product of their efforts was the aircraft called Gyroplane No. 1.[4] However, they abandoned the project due to the design's instability and impracticability.[5] Consequently, Paul Cornu, a French inventor, is considered to have built the first operational VTOL in 1907 with his untethered "Cornu Helicopter."[6] While the initial flight lasted only 20 seconds, reaching a height of around 30 centimeters (cm), Cornu built upon this, and subsequent flights reached a height of around 180 cm.[7] The project was also abandoned due to the aircraft being unreliable and unstable.[8] While these early examples are far away from the current capabilities of VTOL aircraft, they built the foundations from which more ambitious VTOL activities could takeoff.[9]

Both World War I and World War II showed the value of the aircraft (including helicopters) for military purposes, which prompted significant advancements in related technology.[10] For example, helicopters can deploy and extract military personnel and equipment to and from battlefronts without the need for ground infrastructure (e.g., runways and roads).[11] Helicopters can also conduct reconnaissance activities due to their hover capabilities.[12] Helicopters were especially important during the Vietnam War because the United States relied heavily on them due to the jungle terrain of the war theater and their uses for medivacs and remote observations.[13] VTOL aircraft, like helicopters, have continued to play an important role in military

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3 Athanasios Sigalos, Michail Papoutsidakis, Avraam Chatzopoulos & Dimitrios Piromalis, *Design of a Flight Controller and Peripherals for a Quadcopter*, 4 INT'L J. ENG'G APPLIED SCIS. & TECH. 463, 463 (2019).

4 *Id.*

5 *Id.*

6 *The History of Personal VTOL Technology*, JETPACK AVIATION, https://jetpack-aviation.com/history-of-personal-vtol-technology/ [https://perma.cc/K557-XQWQ].

7 *Id.*

8 *Id.*

9 *Id.*

10 *See* Logan Nye, *These Were the Helicopters of World War II*, WE ARE THE MIGHTY (Oct. 12, 2021), https://www.wearethemighty.com/popular/military-helicopters-of-wwii/ [https://perma.cc/R5AW-XP63] (listing helicopters used during World War II).

11 *See id.*

12 *See id.*

13 *Vietnam War Helicopters*, MIL. FACTORY, https://www.militaryfactory.com/aircraft/vietnam-war-helicopters.php [https://perma.cc/C7AQ-HH63].

activities around the world. This can be demonstrated by the illegal war—initiated in 2014 and escalated in 2022—waged by Russia against Ukraine, whereby both sides have used helicopters in direct combat roles.[14] States have also used helicopters for other activities such as search and rescue, policing, and transporting officials.[15]

Helicopters, however, have certain limitations such as speed, range, and altitude.[16] As a result, aircraft with VTOL capabilities that could fly longer, faster, and at higher altitudes were needed, which required looking beyond the helicopter model.[17] These endeavors involved the cooperation of numerous aviation manufacturers, such as Pratt and Whitney, Bell, Boeing, General Electric, and Rolls Royce.[18] Some of the most famous results are the tiltrotor V-22 Osprey, the powered-lift Harrier Jump Jet, and the vertical lift fan and pivoting engine nozzle F35B Lightning II Joint Strike Fighter.[19]

B. Bringing VTOL into the 21st Century

While helicopters have been used for civil activities for decades, the use of VTOL aircraft, outside of the military context, is being embraced at a new level by many stakeholders for civil, commercial applications, with significant efforts in the technical and regulatory domains having already been made.[20] More specifically, this is in the area of utilizing VTOL aircraft to modernize urban mobility by including the third dimension. While

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[14] *See* Sebastien Roblin, *Ukraine Is Quietly Using Its Mi-24 'Flying Tank' Helicopters to Batter Russian Forces*, Bus. Insider (Apr. 27, 2022, 8:18 AM), https://www.businessinsider.com/ukraine-is-using-mi24-flying-tank-helicopters-to-fight-russia-2022-4?international=true&r=US&IR=T [https://perma.cc/VKJ3-JF9S].

[15] *See* Nye, *supra* note 10.

[16] Abhiram Doddi, *Vertical Take-Off and Landing (VTOL)*, Am. Inst. Aeronautics & Astronautics 1, 2 (2016), https://www.colorado.edu/faculty/kantha/sites/default/files/attached-files/158128-154174_-_abhiram_doddi_-_dec_13_2016_228_pm_-_doddi_report.pdf [https://perma.cc/536W-HQMD].

[17] *See id.*

[18] *Id.* at 1.

[19] *See id.* at 2; *VTOL, a Brief History*, Flightline Wkly. (Oct. 19, 2021), https://www.flightlineweekly.com/post/vtol-a-brief-history [https://perma.cc/7SRA-E6DL] (explaining other military attempts at using VTOL aircraft).

[20] An early ambition for using VTOL aircraft for civil uses, which went beyond low-frequency and high-cost chartered helicopter flights, was the 1950s Rotodyne gyroplane designed and built by Fairey Aviation. *See* Justin Parkinson, *Why Did the Half-Plane, Half-Helicopter Not Work?*, BBC News Mag. (Feb. 12, 2016), https://www.bbc.com/news/magazine-35521040 [https://perma.cc/NB4J-BZUB]. This attempt, however, failed because funding was stopped, preventing further steps from being taken. *See id.*

updating and improving mobility in urban areas, also known in certain cases as "smart cities,"[21] the addition of the air component is a more recent development and is seen by many as a necessary addition to improved mobility solutions.[22]

A growing number of people are encountering congestion in cities, and the increased number of motor vehicles is worsening the quality of life in those areas due to the increased levels of greenhouse gases, particles in the air, visual and noise pollution, and associated climate change.[23] To combat these issues, there have been efforts to make greener, smarter, unified, affordable, and more sustainable aviation solutions to address real mobility needs.[24] While this comes with many names, the most prominent name is "Urban Air Mobility" (UAM), which can be seen in numerous European Union (EU) documents and initiatives.[25] Other terms like "Advanced Air Mobility,"[26] "New Air Mobility," and "Innovative Air Mobility" are also used.[27] They may be used interchangeably or to address nuances, so caution is required when working with this term's different acronyms.

A key element for the development of the UAM concept, in addition to the more established unmanned aircraft system (UAS) market, is the use of electric VTOL (eVTOL) aircraft.[28]

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[21] *Smart Cities*, EUR. COMM'N https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en [https://perma.cc/72AP-4SLH].

[22] *See Urban Air Mobility (UAM)*, EUR. COMM'N, https://smart-cities-marketplace.ec.europa.eu/action-clusters-and-initiatives/action-clusters/sustainable-urban-mobility/urban-air-mobility-uam [https://perma.cc/33GU-FKFP].

[23] *See, e.g.*, PwC, MOBILITY INSIGHTS: TACKLING THE GROWING ISSUE OF CONGESTION IN URBAN AREAS 1 (2019,) https://www.pwc.com/us/en/industries/industrial-products/library/mobility-insights-tackling-congestion.html [https://perma.cc/RUP2-TZBF].

[24] *See, e.g.*, ENTE NAZIONALE PER L'AVIAZIONE CIVILE, AAM NATIONAL STRATEGIC PLAN (2021–2030) FOR THE DEVELOPMENT OF ADVANCED AIR MOBILITY IN ITALY 2, https://www.enac.gov.it/sites/default/files/allegati/2022-Mar/01_Piano%20Strategico%20Nazionale%20AAM_ENAC_web%20en-GB.pdf. [https://perma.cc/AW8A-7FQK].

[25] *See, e.g.*, EUR. COMM'N, *supra* note 22; *Urban Air Mobility (UAM)*, EUR. UNION AVIATION SAFETY AGENCY [EASA], https://www.easa.europa.eu/domains/urban-air-mobility-uam [https://perma.cc/K5HG-SBVT].

[26] *See, e.g.*, ENTE NAZIONALE PER L'AVIAZIONE CIVILE, *supra* note 24, at 3.

[27] Konstantinos Andritsos, Benjamyn I. Scott & Andrea Trimarchi, *What Is in a Name: Defining Key Terms in Urban Air Mobility*, 105 J. INTELLIGENT & ROBOTIC SYS. 1, 1–2 (2022).

[28] *See Unmanned Aircraft*, EUR. COMM'N, https://defence-industry-space.ec.europa.eu/eu-aeronautics-industry/unmanned-aircraft_en [https://perma.cc/PBW4-ZX3D].

The reason why these aircraft will play such a significant role in the proposed UAM environment is due to several factors:

1. The aircraft will be electric, as opposed to using conventional combustion engines, so they should produce less noise and direct greenhouse gas emissions.[29]
2. VTOL aircraft will have high safety standards set by regulators that reduce the risks to users and third parties.[30] As a result, they should be safer than other transport modes within urban areas (e.g., walking, e-scooters, and cycling).[31]
3. Ground infrastructure should be minimal as VTOL will only require the land for the vertiport because the rest of the journey will take place in the air.[32] Therefore, there is no need to build roads or rail tracks.[33]
4. The aircraft are planned to be mass produced, with smaller supply chains than traditional aviation, so they will likely be cheaper to manufacture, operate, and maintain.[34]
5. The vehicles and vertiports can easily serve multiple functions, such as passenger transportation, cargo delivery, and emergency services like patient transport.[35]
6. A lot will be automated, so operations can be optimized, human error reduced, and labor costs kept to a minimum.[36]

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[29] *See* EASA, *The European Plan for Aviation Safety (EPAS 2022-2026)*, at 165–72 (Oct. 12, 2021), https://www.easa.europa.eu/downloads/134919/en [https://perma.cc/LEN9-GMEA].

[30] EUR. COMM'N, *supra* note 28.

[31] *Id.*

[32] *See, e.g.*, EASA, *Vertiports: Prototype Technical Specifications for the Design of VFR Vertiports for Operation with Manned VTOL-Capable Aircraft Certified in the Enhanced Category*, at 1 (PTS-VPT-DSN) (Mar. 2022), https://www.easa.europa.eu/downloads/136259/en [https://perma.cc/5TH2-A3ZG].

[33] *Id.*

[34] *See, e.g.*, Gerrard Cowan, *To Mass Produce eVTOL Air Taxis, Aerospace Rethinks Manufacturing*, EVTOL (Dec. 13, 2019), https://evtol.com/features/evtol-air-taxi-manufacturing/ [https://perma.cc/DBU6-R8KM].

[35] *See, e.g.*, Dominique Gillis, Massimiliano Petri, Antonio Pratelli, Ivana Semanjski & Silvio Semanjski, *Urban Air Mobility: A State of Art Analysis*, 12950 LECTURE NOTES COMPUT. SCI. 411, 416–17 (2021).

[36] *See, e.g.*, *What Is UAM*, EASA, https://www.easa.europa.eu/what-is-uam [https://perma.cc/7TQC-GD8N].

7. This new activity can create new economic opportunities, such as jobs, but also streamline current business activities (e.g., delivery services).[37]

Despite all of these benefits, there are also a number of concerns:

1. Societal acceptance, embracement, and adoption are by no means guaranteed, despite being fundamental to the success of UAM.[38]
2. A large number of aircraft is needed to have a noticeable impact on congestion and the environment.[39]
3. More energy is required to fly one passenger than to drive that person, so the increased energy consumption must be justified and sustainable.[40]
4. The airspace is not yet ready for advanced, large-scale UAM activities. This includes the technological creation and subsequent rollout of UAM capable airspaces (e.g., U-space services),[41] and subsequently getting the local municipalities on board.[42]
5. The aircraft need to be built and proven to be safe, including receiving the relevant airworthiness certificates.[43]

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37 *Id.*

38 *See, e.g.*, *EASA Publishes Results of First EU Study on Citizens' Acceptance of Urban Air Mobility*, EASA (May 19, 2021), https://www.easa.europa.eu/newsroom-and-events/press-releases/easa-publishes-results-first-eu-study-citizens-acceptance-urban [https://perma.cc/8ET6-SGYX]; EASA, *Study on the Societal Acceptance of Urban Air Mobility in Europe*, at 7 (May 19, 2021) [hereinafter EASA, *Study on Urban Air Mobility in Europe*], https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf [https://perma.cc/M9PQ-LFER].

39 *See, e.g.*, Tore Johnston, Robin Riedel, & Shivika Sahdev, *To Take Off, Flying Vehicles First Need Places to Land*, McKinsey & Co. (Aug. 2020), https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/to-take-off-flying-vehicles-first-need-places-to-land [https://perma.cc/2Q9D-MWUB].

40 *See, e.g.*, Shashank Sripad & Venkatasubramanian Viswanathan, *The Promise of Energy-Efficient Battery-Powered Urban Aircraft*, 118 Proc. Nat'l Acad. Scis. U.S. 1, 2 (2021).

41 *See, e.g.*, Single European Sky ATM Research [SESAR], *U-Space Blueprint*, at 2 (2017), https://www.sesarju.eu/sites/default/files/documents/reports/U-space%20Blueprint%20brochure%20final.PDF [https://perma.cc/BLH3-YLHX].

42 *See, e.g.*, Eur. Comm'n, *supra* note 22.

43 *See, e.g.*, EASA, *supra* note 25.

6. Battery life needs to be improved and charging times reduced.[44]
7. There is currently no ground infrastructure. This will need to be built and would include having the necessary facilities like compatible charging stations supplied by electricity from renewable sources.[45]
8. The full life cycle has not yet been considered. Batteries contain lithium, which must be mined and then later recycled. Both of these activities are dirty, and lithium is a finite resource required by other sectors (e.g., automobiles and mobile phones).[46]
9. The laws need to be amended, written, or both. While this is underway for aviation safety, other passenger rights and security rules are still unclear.[47]

The above list shows that while there are opportunities and solutions to real mobility needs, many challenges still need to be overcome to actualize UAM.

UAM should, however, not be seen as a technology (e.g., UAS or VTOL aircraft) or as a single service. Rather, it is an ecosystem. Most UAM launching projects involving eVTOL aircraft currently plan a Point A to Point B flying taxi service.[48] This plan could include:

1. City Center–Airport;
2. City Center–Housing in the suburbs;
3. Transport Hub–Transport Hub (e.g., Airport to train station via a VTOL aircraft); or
4. City Center–Sporting Event.[49]

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[44] *See, e.g.*, Elan Head, *What We Know About Lilium's eVTOL Batteries So Far*, eVTOL, (May 12, 2021), https://evtol.com/features/lilium-evtol-batteries-what-we-know/ [https://perma.cc/4KME-N34C].

[45] *See, e.g.*, Robin Lineberger, Aijaz Hussain, Matt Metcalfe & Vincent Rutgers, Deloitte, Infrastructure Barriers to the Elevated Future of Mobility 2–3 (2019), https://www2.deloitte.com/content/dam/insights/us/articles/5103_Infrastructure-barriers-to-elevated-FOM/DI_Infrastructure-barriers-to-elevated-FOM.pdf [https://perma.cc/Z749-VPG8].

[46] *See, e.g.*, Wendover Productions, *Electric Vehicles' Battery Problem*, YouTube (Jan. 11, 2022), https://www.youtube.com/watch?v=9dnN82DsQ2k&ab_channel=WendoverProductions [https://perma.cc/8XD5-FCVF].

[47] *See* discussion *infra* Part III (regulating VTOL and Vertiports).

[48] *See* EASA, *supra* note 25.

[49] *See, e.g.*, *German Firm's Air Taxi Aims to Be Operational for Paris 2024 Olympics*, Reuters (June 21, 2021, 2:07 PM), https://www.reuters.com/lifestyle/sports/german-firms-air-taxi-aims-be-operational-paris-2024-olympics-2021-06-21/ [https://perma.cc/SP2V-CYXC].

These are not the only possible uses; other options could involve cargo delivery, tourist flights (Point A to A), civil functions (e.g., farming and information technology infrastructure), and state functions (e.g., medical and policing). Due to the need for societal acceptance, embracement, and adoption, it is likely that the first UAM cases will have a wider public function such as for emergency services. As of 2022, the UAM market is still in its nascent stage, and although showing increasing momentum, the market has not yet materialized.[50]

It is impossible to put a number on the amount of VTOL aircraft proposals, but some report that there are currently over 200 proposals at different levels of maturity.[51] Some of the more advanced or notable proposals are E-Hang (China),[52] Joby Aviation (United States),[53] Lilium (Germany),[54] and Volocopter (Germany).[55] Further, large manufacturers, such as Airbus (Europe), Bell (United States), Boeing (United States), and Embraer (Brazil) are involved and leverage their decades of experience with aviation safety.[56] In addition, automobile companies like Porsche (Germany), rideshare companies like Uber (United States), and American technology giants like Amazon and Google are also involved.[57] Thus, it is not just the traditional

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50 *See generally Urban Air Mobility (UAM) Market – Growth, Trends, COVID-19 Impact, and Forecasts (2022 – 2035)*, MORDOR INTEL., https://www.mordorintelligence.com/industry-reports/urban-air-mobility-uam-market [https://perma.cc/A5G8-MW4W] (providing an overview of the market's current status).

51 *See, e.g.*, EASA, *Study on Urban Air Mobility in Europe*, *supra* note 38, at 21.

52 *EHang AAV: The Era of Urban Air Mobility Is Coming*, EHANG https://www.ehang.com/ehangaav [https://perma.cc/8JPV-64QZ].

53 JOBY AVIATION, https://www.jobyaviation.com/ [https://perma.cc/YJ5N-V7E5].

54 LILIUM, https://lilium.com/ [https://perma.cc/YNT3-NJ4K].

55 *The Technology Behind Our eVTOL Vision*, VOLOCOPTER, https://www.volocopter.com/solutions/ [https://perma.cc/5GSQ-FMX6].

56 *See Urban Air Mobility: Taking Urban Transport into the Sky*, AIRBUS, https://www.airbus.com/en/innovation/zero-emission/urban-air-mobility [https://perma.cc/FBP3-9MKM]; *Flight Path for the Future of Mobility*, BOEING https://www.boeing.com/NeXt/common/docs/Boeing_Future_of_Mobility_White%20Paper.pdf [https://perma.cc/FF3Y-H4QV]; EVE, https://eveairmobility.com/ [https://perma.cc/W473-HEAH].

57 *See* PORSCHE CONSULTING, THE FUTURE OF VERTICAL MOBILITY: SIZING THE MARKET FOR PASSENGER, INSPECTION, AND GOODS SERVICES UNTIL 2035, at 3 (2018), https://www.porsche-consulting.com/fileadmin/docs/04_Medien/Publikationen/TT1371_The_Future_of_Vertical_Mobility/The_Future_of_Vertical_Mobility_A_Porsche_Consulting_study__C_2018.pdf [https://perma.cc/P9EQ-X8DU]; *The Future of Urban Mobility*, UBER, https://www.uber.com/nl/en/elevate/ [https://perma.cc/8ZBW-XQ63]; Amazon Staff,

aviation manufacturers that are involved, but also new players and nonaviation stakeholders from around the world, with some also planning to be the operators and vertiport providers.

While some of these air vehicle systems are already in advanced certification stages,[58] many are still in the concept stage and may never enter commercial operations. Despite the advances, there are still many legal questions that either remain unanswered or still have to be asked. This Article will focus on one area that still presents legal issues—vertiports.

C. Vertiports and Purpose of this Article

VTOL aircraft require less space to take off and land than traditional passenger aircraft, which require an airport with a runway, and this is one of the main factors why VTOL aircraft are seen as a mobility solution in urban areas.[59] While several companies promote services that come directly to the passenger (such as pickup and drop off near the passenger's office or home), due to safety reasons and the design of urban areas, realistically, there will mostly be fixed locations with the required infrastructure for embarkation and disembarkation. Locations could include areas next to other modes of transport (e.g., train stations and airports), thereby increasing mobility; areas in high population density areas (e.g., city centers); or areas near important or high-use facilities (e.g., business or shopping centers). This may evolve—as technology advances, the encroachment of UAM on daily lives becomes more accepted, urban areas evolve, and safety improves—to a hybrid of fixed locations and ad hoc passenger location pickup. However, there will still need to be fixed locations for, *inter alia*, charging the VTOL aircraft's batteries. Also, operators may desire to have fixed locations so the passengers can rely on a consistent service.[60] Therefore, the vertiport will be a relevant component of UAM and aviation generally in terms of connecting airports to citizens via VTOL aircraft.

Amazon Prime Air Prepares for Drone Deliveries, AMAZON (June 13, 2022), https://www.aboutamazon.com/news/transportation/amazon-prime-air-prepares-for-drone-deliveries [https://perma.cc/78ZS-7NNL]; WING, https://wing.com/ [https://perma.cc/NFF6-RZU2] (Wing is a subsidiary of Alphabet, the parent company of Google).

[58] *See, e.g.*, *#Blog #UAMglossary: DOA and POA*, VOLOCOPTER (Jan. 21, 2022), https://www.volocopter.com/newsroom/blog/blog-uamglossary-no-2-doa-and-poa/ [https://perma.cc/D35B-A7AW] (Volocopter has a Design Organization Approval (DOA) and a Production Organization Approval (POA) from EASA).

[59] *See, e.g.*, EUR. COMM'N, *supra* note 22.

[60] LINEBERGER ET AL., *supra* note 45, at 5.

As a result, numerous designs have been presented for vertiports. A notable example is the VoloPort, which is a collaboration between Volocopter and Skyports.[61] This design was showcased in December 2019 in Singapore.[62] Other manufacturers, such as Lilium, are also looking into the design of vertiports.[63] These developments will cause aircraft manufacturers to evolve and extend into the operational side, since they may serve as both the operator and vertiport provider. These early ideas hint that key stakeholders, including the regulators, envisage a defined area where the VTOL aircraft can land and engage in services.

Despite the importance of vertiports, it is not automatically clear how these relate to long-established aviation ground infrastructure, notably those called "aerodrome," "airport," and "heliport," and how the rules relating to these infrastructure types apply to vertiports. Therefore, a number of questions arise: what is a vertiport; how do vertiports relate to other aviation infrastructure; what are the legal implications of having different terms; what laws apply to vertiports? This Article seeks to address these questions by first providing context, looking at the rise of VTOL for civil uses and the need for vertiports in Part I. Following this, Part II analyzes the current and proposed legal landscape in Europe. This analysis shows how vertiports are currently regulated and highlights the steps that still need to be taken. While recourse to international and United States materials does occur, the focus of this Article is on EU law and the use of VTOL aircraft in the EU Single European Sky. Part III then examines the different terms that exist and their definitions. This Part highlights the similarities and differences that exist between the different terms, thus allowing the relevant laws to be appropriately identified and their scope understood. Finally, Part IV discusses some of the legal consequences by focusing on specific EU regulations. Thus, Part IV reveals the real-life implications. The Article then ends with a conclusion that summarizes the answers to the above questions.

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61 *World's First Full-Scale Air Taxi VoloPort Unveiled in Singapore*, VOLOCOPTER (Oct. 21, 2019), https://www.volocopter.com/newsroom/worlds-first-full-scale-air-taxi-voloport-unveiled-in-singapore/ [https://perma.cc/VX8P-PMBS].

62 *Id.*

63 *Designing a Scalable Vertiport*, LILIUM (July 2, 2020), https://lilium.com/newsroom-detail/designing-a-scalable-vertiport [https://perma.cc/DPN8-N2EF].

II. REGULATING VTOL AND VERTIPORTS IN THE EUROPE UNION[64]

A. BACKGROUND: REGULATORY LANDSCAPE

Since 2015, the EU has been active in shaping polices for safe, secure, and sustainable operations and manufacturing of unmanned aircraft and their related systems (i.e., UAS). With the enactment of EU Regulation 2018/1139,[65] which contains the "Common Rules in the Field of Civil Aviation," the EU gained the competencies for civil unmanned aircraft of all weights.[66]

This Regulation includes the essential requirements for unmanned aircraft and provides the EU with the legal basis to adopt relevant implementing acts and delegated acts (i.e., Commission regulations).[67] The European Union Aviation Safety Agency (EASA) is mandated to take the leading role in the development of these rules.[68]

The regulatory framework produced three main categories of UAS operations:

- [T]he "open" category is a category of UAS operation that, considering the risks involved, does not require a prior authorisation by the competent authority nor a declaration by the UAS operator before the operation takes place;
- [T]he "specific" category is a category of UAS operation that, considering the risks involved, requires an authorisation by the competent authority before the operation takes place, taking into account the mitigation measures identified in an operational risk assessment, except for certain standard scenarios where a declaration by the operator is sufficient or when the operator holds a light UAS operator certificate (LUC) with the appropriate privileges;
- [T]he "certified" is a category of UA operation that, considering the risks involved, requires the certification of the UAS, a licensed remote pilot and an operator approved by the com-

[64] For a more detailed discussion on the EU Regulations, see Benjamyn I. Scott, *Open Skies for Unmanned Aircraft in Europe: An Outlier or a New Approach?*, 46 AIR & SPACE L. 57 (2021).

[65] Commission Regulation 2018/1139, 2018 O.J. (L 212) 1.

[66] Prior to 2018, Commission Regulation 216/2008 provided that unmanned aircraft with a Maximum Takeoff Mass (MTOM) of less than 150 kilograms were the competencies of the European Union Members States. *See* Commission Regulation 216/2008, annex II, 2008 O.J. (L 79) 32–33.

[67] Commission Regulation 2018/1139, *supra* note 65, annex IX.

[68] *Id.* arts. 57–58.

petent authority, in order to ensure an appropriate level of safety.[69]

Through EASA, the EU prioritized the development of regulations for operations in open and specific categories based on practical needs.[70] This led to a series of Regulations:

- Commission Delegated Regulation (EU) 2019/945 on Unmanned Aircraft Systems and on Third-Country Operators of Unmanned Aircraft Systems.[71]
- Commission Implementing Regulation (EU) 2019/947 on the Rules and Procedures for the Operation of Unmanned Aircraft.[72]
- Commission Implementing Regulation (EU) 2021/664 on a Regulatory Framework for the U-Space.[73]

The regulatory framework for operations in the certified category is currently under development,[74] as dictated in EASA's "European Plan for Aviation Safety 2022–2026."[75]

B. Regulating VTOL Aircraft in the Certified Category

Despite EASA not yet producing regulations on the certified category, the existing rules indicate what this category would cover.[76] Article 40 of Regulation 2019/945 covers the

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69 *Drones – Regulatory Framework Background*, EASA, https://www.easa.europa.eu/domains/civil-drones/drones-regulatory-framework-background#:~:text=A%20general%20concept%2C%20establishing%20three,Technical%20Opinion%20in%20December%202015 [https://perma.cc/2X9N-DTD9].

70 *See, e.g.*, Commission Regulation 2019/945, 2019 O.J. (L 152) 1; Commission Regulation 2020/1058, 2020 O.J. (L 232) 1; Commission Regulation 2019/947, 2019 O.J. (L 152) 45; Commission Regulation 2020/639, 2020 O.J. (L 150) 1; Commission Regulation 2020/746, 2020 O.J. (L 176) 13–14; Commission Regulation 2021/1166, 2021 O.J. (L 253) 49–50; Commission Regulation, 2022/425, 2022 O.J. (L 87) 20–21; Commission Regulation 2021/664, 2021 O.J. (L 139) 161; Commission Regulation 2021/665, 2021 O.J. (L 139) 184–86; Commission Regulation 2021/666, 2021 O.J. (L 139) 187–88.

71 Commission Regulation 2019/945, *supra* note 70, at 1; Commission Regulation 2020/1058, *supra* note 70, at 1.

72 Commission Regulation 2019/947, *supra* note 70, at 45; Commission Regulation 2020/639, *supra* note 70, at 1; Commission Regulation 2020/746, *supra* note 70, at 13–14; Commission Regulation 2021/1166, *supra* note 70, at 49–50; Commission Regulation 2022/425, *supra* note 70, at 20–21.

73 Commission Regulation 2021/664, *supra* note 70, at 161; Commission Regulation 2021/665, *supra* note 70, at 184–86; Commission Regulation 2021/666, *supra* note 70, at 187–88.

74 Scott, *supra* note 64, at 66.

75 EASA, *supra* note 29, at 166.

76 *See id.* (the planned rules cover initial airworthiness, flight-crew licensing, air operations, aerodromes, air traffic management, and air navigation services).

"[r]equirements for UAS operated in the 'certified' and 'specific' categories."[77] It states that the "design, production[,] and maintenance of UAS shall be certified if the UAS" falls into one or more of the following areas:[78]

- The unmanned aircraft has a dimension of three meters or more and "is designed to be operated over assemblies of people."[79] Therefore, the size of the aircraft plays a role, but this is also balanced with the risk to third parties, namely the unmanned aircraft's interaction with assemblies of people.[80]
- The unmanned aircraft is "designed for transporting people." This, therefore, refers to flying taxi services.[81]
- The unmanned aircraft is "designed for the purpose of transporting dangerous goods," whereby a "high level of robustness" is needed to "mitigate the risks for third parties in case of an accident."[82]
- The unmanned aircraft is operated in the specific category,[83] and following a risk assessment, the competent authority issues an operational authorization issued by the competent authority, following a risk assessment.[84] This considers that the risk of the operation cannot be adequately mitigated without the certification of the UAS.

Relevant to this Article is the transportation of people whereby EASA plans to draft the rules for initial airworthiness,

77 Commission Regulation 2019/945, *supra* note 70, art. 40.

78 *See id.* art.40.1(a).

79 *Id.*; *see also* Commission Regulation 2019/947, *supra* note 70, art. 2(3) (defining "assemblies of people" as "gatherings where persons are unable to move away due to the density of the people present").

80 Commission Regulation 2019/947, *supra* note 70, art. 2(3).

81 Commission Regulation 2019/945, *supra* note 70, art. 40.1(b); *see also* Commission Regulation 2019/947, *supra* note 70, art. 2(19); EASA, *supra* note 29, at 166.

82 Commission Regulation 2019/945, *supra* note 70, art. 40.1(c); Commission Regulation 2019/947, *supra* note 70, art. 2(11), ("'[D]angerous goods' means articles or substances, which are capable of posing a hazard to health, safety, property[,] or the environment in the case of an incident or accident, that the unmanned aircraft is carrying as its payload, including in particular: (a) explosives (mass explosion hazard, blast projection hazard, minor blast hazard, major fire hazard, blasting agents, extremely insensitive explosives); (b) gases (flammable gas, non-flammable gas, poisonous gas, oxygen, inhalation hazard); (c) flammable liquids (flammable liquids; combustible, fuel oil, gasoline); (d) flammable solids (flammable solids, spontaneously combustible solids, dangerous when wet); (e) oxidising agents and organic peroxides; (f) toxic and infectious substances (poison, biohazard); (g) radioactive substances; (h) corrosive substances.").

83 *See* Commission Regulation 2019/947, *supra* note 70, art. 5.

84 *Id.* art. 11; Commission Regulation 2019/945, *supra* note 70, art. 40.1(d).

flight-crew licensing, air operations, aerodromes, air traffic management, and air navigation services.[85] EASA will consider three types of operations when drafting the rules:

1. [Type 1 operations]: [I]nstrument flight rules (IFR) operations of UAS for the carriage of cargo in airspace classes A–C (ICAO airspace classification) and taking off from and/or landing at aerodromes falling under the Basic Regulation.
2. [Type 2 operations]: [O]perations of UAS taking off and/or landing in a congested (e.g. urban) environment using predefined routes in the U-space airspace (part of the operation could be in a non-congested, e.g., rural, environment). These include operations of unmanned VTOL aircraft carrying passengers (e.g., air taxis) or cargo (e.g., goods delivery services).
3. [Type 3 operations]: [S]ame as for type #2 operations with VTOL aircraft with a pilot on board, including operations out of the U-space airspace. While this task will also consider emerging technologies such as electric and hybrid propulsion as [an] integral part of the drones' design, the dedicated RMT.0731 will address in particular the CAW aspects related to these technologies.[86]

EASA will start with type 3 operations because piloted VTOL activities carrying passengers are planned to be the first formulation.[87] After lessons are learned and technologies are improved, the pilot will be taken out of the aircraft and type 2 operations will commence.[88] Thus, EASA will then draft rules for type 2 operations. Finally, as type 1 operations will take longer to actualize, the rules relevant to type 1 operations will be developed last by EASA.[89] However, there will be overlap between the various rules, and the work done for one type can be used for another.

Linked to EASA's work on the certified category is the special condition vertical takeoff and landing, published on July 2, 2019.[90] The special conditions, used in the certification process, apply to person-carrying VTOL heavier-than-air aircraft with

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85 *See* EASA, *supra* note 29, at 206.

86 *Id.* at 166.

87 *Id.*

88 *Certified Category - Civil Drones*, EASA, https://www.easa.europa.eu/domains/civil-drones/drones-regulatory-framework-background/certified-category-civil-drones [https://perma.cc/N799-6U63].

89 *See id.*

90 *See id.*

lift/thrust units used to generate powered lift and control.[91] It allows VTOL aircraft to receive certification under the existing rules while the certified category rules are being developed.[92]

It is clear that EASA separated unmanned aviation from manned aviation, and UAM technology and operations have fallen on the side of unmanned aviation despite type 2 operations having a pilot.[93] This is also the case for the ground infrastructure.[94] As a result, EASA has broken away from terms like "aerodrome," "airport," and "heliport," which are traditionally used in manned aviation, and is instead using "vertiport" for certified category ground infrastructure.[95] This shift is evident with the publication of the "Prototype Technical Specifications for the Design of VFR Vertiports for Operation with Manned VTOL-Capable Aircraft Certified in the Enhanced Category" (Vertiport Manual).[96]

C. Vertiports

The Vertiport Manual was written by EASA with the support of expert stakeholders, including future vertiport companies and VTOL manufacturers, and it contains guidance to urban planners, local decision makers, and related industries to enable the safe design of vertiports that will serve these new types of vertical takeoff and landing aircraft, which are already at an advanced stage of development.[97] Therefore, the Manual is a tool to help (a) municipalities and vertiport designers with the integration of the ground infrastructure into urban areas, and (b) VTOL manufacturers with the building of the VTOL aircraft.[98] This is just the first step, whereby the following step will be a full-scale rulemaking task (RMT.230) during which EASA will de-

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91 EASA, *Special Condition for Small-Category VTOL Aircraft*, at 7, Doc. No. SC-VTOL-01 (July 2, 2019), https://www.easa.europa.eu/sites/default/files/dfu/SC-VTOL-01.pdf [https://perma.cc/NMX8-67VW] ("This Special Condition prescribes airworthiness standards for the issuance of the type certificate, and changes to this type certificate, for a person-carrying vertical take-off and landing (VTOL) heavier-than-air aircraft in the small category. This Special Condition is applicable to aircraft with lift/thrust units used to generate powered lift and control and with more than two lift/thrust units used to provide lift during vertical take-off or landing.").

92 *See id.*

93 *See id.* at 5.

94 *See* Eur. Comm'n, *supra* note 28.

95 EASA, *supra* note 32.

96 *Id.*

97 *Id.* at 1.

98 *Id.*

velop the full spectrum of regulatory requirements to ensure safe vertiport operations.[99] This will include the detailed design specifications, the requirements for authorities to oversee vertiport operations, and the organizational and operational requirements for vertiport operators.[100] The United States has created a comparable document on "Vertiport Design," which is still a draft.[101]

III. DEFINITION OF VERTIPORT

A. Introduction

The term "vertiport" is not defined in any primary EU law or secondary source. However, EASA's special condition does provide a definition.[102] Despite not being enshrined in an EU regulation, the special condition comprises part of the certification process, so it has limited legal effect.[103] Further, the same definition can also be found in the Vertiport Manual.[104] The Veriport Manual provides that "'[v]ertiport' means an area of land, water, or structure that is used or intended to be used for the landing, take-off, and movement of VTOL-capable aircraft."[105]

The catchall wording of "land, water, or structure" is taken from the International Civil Aviation Organization's (ICAO's) Annex 14 on Aerodromes and the EASA Basic Regulation.[106] As a result, it includes all parts of the *terra* ("land"); bodies of water such as oceans, seas, rivers, and lakes ("water"); and fabricated areas that include buildings, offshore platforms, and boats ("structures").[107]

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99 *Id.*

100 *Id.*

101 *See* Michael A.P. Meyers, FAA, Engineering Brief No. 105, Vertiport Design (2022), https://www.faa.gov/airports/engineering/engineering_briefs/drafts/media/eb-105-vertiport-design-industry-draft.pdf [https://perma.cc/834Z-PY43].

102 EASA, *supra* note 91, at 7.

103 *See* Benjamyn I. Scott & Rita Sousa Uva, *The Role of Aviation Safety 'Soft Law' in the European Union Regulatory Landscape*, 69 Zeitschrift für Luft-und Weltraumrecht 604, 604–27 (2020) (providing more information on the legal effect of EASA rulemaking task documents).

104 EASA, *supra* note 32, at 18.

105 *Id.*

106 *See* Int'l Civ. Aviation Org. [ICAO], *Annex 14 to the Convention on International Civil Aviation: Aerodromes*, at 1-2 (8th ed. July 2018.), https://standart.aero/en/icao/book/annex-14-v-1-aerodromes-aerodrome-design-and-operations-en-cons [https://perma.cc/ZR6U-UWNV].

107 *Id.*

The phrase "used or intended to be used" is another catchall construction, which found prominence in UAS rules, and it covers actual use, failed use, or use that never actualized.[108] "Landing and takeoff" is broad and is not limited to, for example, commercial operations; it does not require the embarkation or disembarkation of passengers, baggage, cargo, or mail. Rather, it refers to the aircraft breaking or making contact with the land, water, or structure.[109]

The final criterion is, however, used to limit the scope of the term "vertiport" and differentiate from existing terms like "aerodrome," "airport," and "heliport."[110] This criterion is that the aircraft must specifically be a VTOL aircraft. Thus, it ensures that EASA's approach of placing VTOL aircraft outside of manned aviation is maintained.[111] The term "VTOL" seems to be axiomatic in that it describes a capability of an aircraft to start and end operations using vertical flight. However, it requires more attention because it has a long history within aviation, along with a new focus due to UAM within the context of EASA UAS rulemaking activities.[112]

Interestingly, for comparison, the United States has given a similar definition to "vertiport" in its Engineering Brief No. 105 Vertiport Design, defining it as an "area of land or a structure, used or intended to be used, for electric, hydrogen, and hybrid VTOL landings and takeoffs . . . includ[ing] associated buildings and facilities."[113] However, the document also introduces a new term: "Vertistop."[114] A vertistop is "[a]n area similar to a vertiport, except that no charging, fueling, defueling, maintenance, repairs, or storage of aircraft are permitted."[115] As a result, this would be a vertiport with less facilities, as opposed to an ad hoc area used for a onetime drop-off or pickup.

B. Vertical Takeoff and Landing

1. Introduction

The term "VTOL" is not defined in international law or the ICAO Annexes to the Convention on International Civil Avia-

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108 *See id.*; EASA, *supra* note 32, at 18.
109 ICAO, *supra* note 106, at i-6, i-10.
110 See *infra* Section III.C for an analysis of these terms.
111 *Infra* Section III.C.
112 See *supra* Part II for a discussion of EU regulation of VTOL and vertiports.
113 Meyers, *supra* note 101, at 9.
114 *Id.*
115 *Id.*

tion.[116] However, due to the expected introduction of commercial VTOL aircraft for civil applications for mobility solutions, such as flying taxis, some bodies have defined the term.

The United States has introduced the term "VTOL Mode" into law: "[T]he aircraft state or configuration having the rotors orientated with the axis of rotation in a vertical manner (i.e., nacelle angle of approximately 90 degrees) for vertical takeoff and landing operations."[117] Such an approach has also been adopted by the North Atlantic Treaty Organization (NATO), which utilizes the term VTOL aircraft (or short take-off and landing aircraft) to mean "[a]n aircraft capable of executing a vertical take-off and landing, a short take-off and landing[,] or any combination of these modes of operation."[118]

EASA, on the other hand, has adopted a narrower definition. EASA stated in its Vertiport Manual that a "VTOL-capable aircraft" is "a heavier-than-air aircraft, other than aeroplane or helicopter, capable of performing vertical take-off and landing by means of more than two lift/thrust units that are used to provide lift during the take-off and landing."[119] As a result, it excludes both aeroplanes[120] (i.e., fixed-wing aircraft) and helicopters,[121] as well as single lift/thrust units from its scope. This can be explained as the Vertiport Manual was born out of

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116 *See* ICAO, *supra* note 106.

117 14 C.F.R. § 36.1(i) (2022).

118 N. Atl. Treaty Org. [NATO], NATO Glossary of Terms and Definitions (English and French), at 135, NATO Doc. AAP-06 (2021), https://www.academia.edu/41384738/NATO_GLOSSARY_OF_TERMS_AND_DEFINITIONS_ENGLISH_AND_FRENCH_GLOSSAIRE_OTAN_DE_TERMES_ET_D%C3%89FINITIONS_ANGLAIS_ET_FRAN%C3%87AIS [https://perma.cc/BT3X-FKDA]. NATO defines VTOL as "[t]he capability of an aircraft to take-off and land vertically and to transfer to or from forward motion at heights required to clear surrounding obstacles." *Id.*

119 EASA, *supra* note 32, at 19.

120 ICAO, *Annex 2 to the Convention on International Civil Aviation: Rules of the Air*, at 1-1 (10th ed. 2005), https://www.icao.int/Meetings/anconf12/Document%20Archive/an02_cons%5B1%5D.pdf [https://perma.cc/M4DH-TGQ3] (defining "[a]eroplane" as a "power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight").

121 ICAO, *Annex 7 to the Convention on International Civil Aviation: Aircraft Nationality & Registration Marks*, at 1 (4th ed. 1981), https://www.pilot18.com/wp-content/uploads/2017/10/Pilot18.com-ICAO-Annex-7-Aircraft-Nationality-and-Registration-Marks.pdf [https://perma.cc/77EC-K4MD] (defining "[h]elicopter" as a "heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes").

EASA's UAS Rulemaking Task[122] and as the certified category of UAS has a focus on passenger transportation.[123] As a result, EASA is consistent in distinguishing traditional aviation (e.g., crewed helicopters) from the emerging UAM sector (crewed and uncrewed VTOL aircraft).[124] While EASA's methodology is clear, its hypothesis is not so apparent. In other words, why did EASA need to so clearly distinguish the ground infrastructure for certified category aircraft from helicopters?

While there are differences between these definitions, there are also common elements. Here, VTOL requires an "aircraft"[125] that is capable of a static (vertical) takeoff and landing with hover capabilities, like a "helicopter," as opposed to purely horizontal takeoff and landing such as with fixed-wing "aeroplanes."[126]

2. *Untangling the Alphabetti Spaghetti*

While "VTOL" is widely used, there are related terms that may be a subset or a complementary function of the aircraft. As a result, these terms must be discussed and understood so the proper scope of discussion and nuances can also be understood.

1. Electric VTOL (eVTOL): This is a subcategory of VTOL aircraft that uses electric power for flight as opposed to combustion engines.[127]
2. Conventional takeoff and landing (CTOL): This refers to horizontal takeoff and landing, which is used by traditional airplanes and often includes runways.[128]

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[122] *See* EASA, *Introduction of a Regulatory Framework for the Operation of Drones*, at 16 (June 2022), https://www.easa.europa.eu/downloads/136705/en [https://perma.cc/EGF2-5RVJ] (providing more information on EASA's Rulemaking Task 0230).

[123] *See supra* Part II for more discussion on the certified category.

[124] *See Positioning Helicopters in the Urban Air Mobility Ecosystem*, AEROSPACE & DEF. INDUS. ASS'N EUR. (June 22, 2021), https://asd-europe.org/positioning-helicopters-in-the-urban-air-mobility-ecosystem [https://perma.cc/3PU8-ZU22].

[125] ICAO, *supra* note 120, at 1-1 (defining "[a]ircraft" as "[a]ny machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface"); *see also* Commission Regulation 2018/1139, *supra* note 65, art. 3(28).

[126] ICAO, *supra* note 120, at 1-1.

[127] EASA, *supra* note 25.

[128] *Different Types of Aircraft Takeoff and Landing*, UNMANNED ENGINEERIA BLOG (Nov. 23, 2015), https://unmannedengineeriablog.wordpress.com/2015/11/23/different-types-of-aircraft-takeoff-and-landing/ [https://perma.cc/F2Y3-MHUT].

3. Short takeoff and landing (STOL): This is similar to CTOL, but the horizontal distances are shorter.[129]
4. Short takeoff and vertical landing aircraft (STOVL): This is where the aircraft is only capable of STOL for takeoff and only VTOL for landing.[130]
5. Vertical or short takeoff and landing aircraft (VSTOL): This is where the aircraft is capable of STOL and VTOL for both takeoff and landing.[131]

It can thus be concluded that eVTOL is a subset of VTOL, and STOL is a subset of CTOL. However, STOVL and VSTOL can be seen as subsets of both VTOL and CTOL capabilities. Therefore, it is, important to keep in mind that a VTOL capable aircraft may be able to also land horizontally. This may also be the case for emergency landings, as the VTOL aircraft may have glide capabilities designed into the aircraft in case of power loss to allow it to land safely.[132] This may be necessary where autorotation or parachutes are not possible or practical.

3. Classification of and Within Vertical Takeoff and Landing

In addition to different acronyms, there are also different VTOL aircraft types that are either codified in aviation regulatory materials or exist in technical discussions. All of the following are heavier-than-air aircraft, which means they are not free balloons, captive balloons, or airships,[133] and may be types of VTOL aircraft:

- Rotorcraft: An aircraft with one or more rotors (i.e., not an airplane or ornithopter).[134]
- Helicopter: A subclassification of rotorcraft that achieves "flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes."[135]

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[129] *See* NATO, *supra* note 118, at 119 ("An aircraft capable of clearing a 15-metre (50-foot) obstacle within 450 metres (1,500 feet) of commencing take-off or, in landing, of stopping within 450 metres (1,500 feet) after passing over a 15-metre (50-foot) obstacle.").

[130] *Id.* ("A fixed-wing aircraft capable of clearing a 15 metres (50-foot) obstacle within 450 metres (1,500 feet) of commencing its take-off run, and capable of landing vertically.").

[131] *Id.* at 135 ("An aircraft capable of executing a vertical take-off and landing, a short take-off and landing[,] or any combination of these modes of operation.").

[132] *Id.* at 44.

[133] *See* ICAO, *supra* note 121, at 2 (Table 1–Classification of Aircraft).

[134] *See id.* (defining "[r]otorcraft" as a "power-driven heavier-than-air aircraft supported in flight by the reactions of the air on one or more rotors").

[135] *Id.* at 1.

- Gyroplane: Another subclassification of rotorcraft that is "supported in flight by the reactions of the air on one or more rotors which rotate freely on substantially vertical axes."[136]
- Gyrodyne: It uses vertical axis for lift and a horizontal axis for thrust.[137]
- Cyclogyro or Cyclocopter: This uses a horizontal axis, and its rotor is akin to a paddle steamer boat.[138]
- Tiltrotor: They achieve lift and propulsion using one or more powered tilt rotors, typically mounted on the wings.[139]
- Tiltwings: They achieve lift and propulsion using one or more powered rotors mounted on the wings where either the wings or the rotors themselves tilt.[140]
- Powered-lift: These rely on engine-driven lift devices or engine thrust for the VTOL part of the flight.[141]
- Tailsitter: An aircraft that takes off horizontally by sitting on its tail and then tilts horizontally for forward flight.[142]

There are, therefore, different types of VTOL aircraft that each must be considered because they have different features. However, due to the design choices by leading VTOL manufac-

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136 *Id.*

137 *Gyrodyne*, SKYBRARY, https://skybrary.aero/articles/gyrodyne [https://perma.cc/6SWY-4QMG]. A famous example of a gyrodyne is the Rotodyne, which is widely regarded as the forerunner to Urban Air Mobility. *See* 14 C.F.R. § 1.1 (2022) ("Gyrodyne means a rotorcraft whose rotors are normally engine-driven for takeoff, hovering, and landing, and for forward flight through part of its speed range, and whose means of propulsion, consisting usually of conventional propellers, is independent of the rotor system.").

138 *See, e.g.*, *CycloTech Passenger Demonstrator*, ELECTRIC VTOL NEWS, https://evtol.news/CycloTech-Passenger-Demonstrator [https://perma.cc/BDS2-F3SN].

139 *See* 14 C.F.R. § 36.1 (2022) ("Tiltrotor means a class of aircraft capable of vertical take-off and landing, within the powered-lift category, with rotors mounted at or near the wing tips that vary in pitch from near vertical to near horizontal configuration relative to the wing and fuselage.").

140 Tiltrotors and tiltwings are often considered together. *See What It Takes to Design an Aircraft from Scratch*, LILIUM (Sept. 24, 2020), https://lilium.com/newsroom-detail/lilium-architecture-design-principles [https://perma.cc/NQ6U-MTCS].

141 14 C.F.R. § 1.1 (2022) ("Powered-lift means a heavier-than-air aircraft capable of vertical takeoff, vertical landing, and low speed flight that depends principally on engine-driven lift devices or engine thrust for lift during these flight regimes and on nonrotating airfoil(s) for lift during horizontal flight."); *see, e.g.*, *Hawker Siddeley – BAe Harrier: The World's First Operational V/STOL Strike Fighter*, BAE SYS., https://www.baesystems.com/en-uk/heritage/hawker-siddeley-harrier2 [https://perma.cc/5PQ3-CJY5].

142 *See Tailsitters vs. Quadplanes – Why a VTOL Tailsitter Is the Best Surveying Drone for Your Mapping Missions*, WINGTRA (Nov. 29, 2018), https://wingtra.com/tailsitters-vs-quadplanes-why-a-vtol-tailsitter-is-the-best-surveying-drone-for-your-mapping-missions/ [https://perma.cc/J4HY-Q47Q].

turers, EASA focuses on multicopter (e.g., Volocopter and eHang); tiltwing/tiltrotor (e.g., Lilium); and Gyrodynes (e.g., Jaunt and Pal-V) eVTOL aircraft.[143]

C. Other Relevant Terms

1. *Aerodrome*

The term "aerodrome" is defined in the EASA Basic Regulation as "a defined area, on land or on water, on a fixed, fixed offshore[,] or floating structure, including any buildings, installations[,] and equipment thereon, intended to be used either wholly or in part for the arrival, departure[,] and surface movement of aircraft."[144] While the definition has notable similarities with the definition of "vertiport," it, nevertheless, contains important differences. First, it includes surface movements. This relates more to fixed-wing aircraft that need to taxi to and from the runway, but it does not exclude VTOL operations as seen in the EU's definition of "heliport."[145] Second, this definition is broader as it applies to "aircraft" as opposed to just VTOL aircraft. Since a VTOL aircraft is an "aircraft," it can be interpreted that a "vertiport" is a type of "aerodrome."

EASA concluded that it "would not be appropriate to subject all aerodromes to common rules."[146] The EU aviation safety rules on aerodromes only apply to "the design, maintenance[,] and operation of aerodromes, including the safety-related equipment used at those aerodromes, located in the territory to which the Treaties apply," which are "open to public use;" "serve commercial air transport;" and "have a paved instrument runway of 800 metres or more, or exclusively serve helicopters using instrument approach or departure procedures."[147]

Vertiports used for services like passenger transport will be open to the public and will serve commercial air transport. However, they are unlikely to have runways due to the technical configurations of VTOL aircraft, and thus must exclusively serve

143 *See* EASA, *supra* note 29, at 166.

144 Commission Regulation 2018/1139, *supra* note 65, art. 3(16); *see also* ICAO, *supra* note 106, at 1-2 (defining "[a]erodrome" as a "defined area on land or water (including any buildings, installations[,] and equipment) intended to be used either wholly or in part for the arrival, departure[,] and surface movement of aircraft").

145 See *infra* Section III.C.3 for a definition of "heliport."

146 Commission Regulation 2018/1139, *supra* note 65, pmbl. (7).

147 *Id.* art. 2(1)(e)(i)–(iii).

helicopters.[148] As a result, vertiports will likely not fall within the scope of the EU rules on aerodromes, which would support the EU's decision to introduce the term "vertiport" as a distinguisher from other ground infrastructure. Therefore, as stated in the Preamble to the Basic Regulation, such aerodromes "should remain under the regulatory control of the Member States, without any obligation under this Regulation on other Member States to recognise such national arrangements."[149] As a result, there are different rules for different categories of aerodromes.

This results in an interesting situation where the EU rules exclude vertiports from their scope, but EASA includes vertiports within the UAS regulatory framework.[150] The EASA Basic Regulation does not provide a buyback mechanism for vertiports—whether for manned or unmanned aircraft.[151] It would, therefore, seem that EASA is extending the scope of the Basic Regulation to include vertiport aerodromes.

Member states can also exempt aerodromes that handle "no more than 10[,]000 commercial air transport passengers per year and no more than 850 movements related to cargo operations per year," provided that "such exemption does not endanger compliance with the essential requirements referred to in Article 33."[152] This tool has not yet been implemented within the context of vertiports, as the EU rules are still being drafted. However, it could be a tool for member states that offers them some flexibility, but that also creates differences among member states, which the EU Regulations on UAS have tried to limit.

2. *Airport*

The term "aerodrome" dominates aviation safety material within the EU and at the ICAO level.[153] However, the term "airport" is also used in EU regulations. While this term is not defined in the aviation safety regulations or by ICAO, other sources of EU law can help. Regulation 1008/2008, which "regulates the licensing of Community air carriers, the right of Com-

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[148] See *supra* Section III.B.3 for more information on helicopters.
[149] Commission Regulation 2018/1139, *supra* note 65, pmbl. (7).
[150] *See supra* Section II.B.
[151] *See* Commission Regulation 2018/1139, *supra* note 65.
[152] *Id.* art. 2(7).
[153] *See ADR – Aerodromes*, EASA, https://www.easa.europa.eu/regulations/adr-aerodromes [https://perma.cc/B5MX-MPYT] (listing the EU safety rules on aerodromes).

munity air carriers to operate intra-Community air services[,] and the pricing of intra-Community air services," utilizes this term.[154] As the Regulation focuses on commercial point A to point B transportation, the place of departure and arrival are both extremely relevant: "'[A]irport' means any area in a Member State especially adapted for air services."[155]

The geographical location is phrased much broader than in the definition of "aerodrome," but there is a qualifier that it must be adapted for "air services."[156] An "'air service' means a flight or a series of flights carrying passengers, cargo[,] and/or mail for remuneration and/or hire."[157] As a result, it must have a commercial element, which would involve transporting people, cargo, and/or mail by VTOL aircraft.[158] It can, therefore, be assumed, that a vertiport used for "air services" is an airport, so long as it is especially adapted. As a result of this, ad hoc landing areas (potentially, within the language of the United States, a vertistop) would not count as an airport.

3. Heliport

The final term that must be considered is "heliport," which has been defined as "[a]n aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure, and surface movement of helicopters."[159] The geographical area must be either an "aerodrome," thus supporting the above conclusion that a facility that serves only VTOL aircraft can be an aerodrome, or a "structure."[160] Therefore, following this functional approach, if the VTOL aircraft can be categorized as a "helicopter" and it uses a vertiport, that vertiport can be considered also as a "heliport."[161]

IV. WIDER CONTEXT

The introduction of "vertiport" as a distinguisher or subcategory of "airport," "aerodrome," or "heliport" raises legal questions of scope and application of specific aviation regulations

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154 Commission Regulation 1008/2008, art. 1(1), 2008 O.J. (L 293) 4.
155 *Id.* art. 2(7).
156 *See id.*
157 *Id.* art. 2(4).
158 *See id.*
159 *See* ICAO, *supra* note 106, at 1-5; *see also* Commission Regulation 2017/373, 2017 O.J. (L 62) 1.
160 *See* ICAO, *supra* note 106, at 1-5.
161 See *supra* Section III.B.3 for more information on helicopters.

within the EU. For example, while none of the EU regulations currently use "vertiport," they do use the other related terms.[162] This has already been shown within the context of the aviation safety rules and Regulation 1008/2008,[163] but it could have consequences for other regulations. This will be demonstrated below within the context of passenger rights and security. These two areas were selected to demonstrate how broad the implications highlighted in this Article are. However, the other areas should also be considered.

One example, which could have wide-ranging consequences for an emerging UAM market, is Regulation 261/2004.[164] This Regulation determines the minimum rights for passengers in cases of denied boarding, cancellation, or delay.[165] Its scope covers "passengers departing from an airport located in the territory of a Member State to which the Treaty applies," among other classes of passengers.[166] Therefore, if a passenger service operating within the EU using a VTOL aircraft departs from a vertiport that satisfies the EU definition of an "airport," this criterion is satisfied. There are other criteria that must also be assessed to determine the applicability of the Regulation; however, this is beyond the scope of this Article. However, if the Regulation is applicable, new UAM services would be subject to a robust liability regime that is arguably passenger friendly and designed to govern a mature industry.

Another example is Regulation 300/2008, which "establishes common rules to protect civil aviation against acts of unlawful interference that jeopardise the security of civil aviation."[167] Among other applications, the Regulation applies to "all airports or parts of airports located in the territory of a Member State that are not exclusively used for military purposes."[168] Again, if the vertiport can be considered an "airport," there is relevance for this in the aviation security rules. For example, Regulation 300/2008 mandates, among other things, certain controls and requirements on allowed methods of screening, prohibited articles to be carried by passengers, and restricted

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162 *See supra* Section III.C.

163 See *supra* Section III.C.2 for more information on Commission Regulation 1008/2008, 2008 O.J. (L 293) 3.

164 Commission Regulation 261/2004, 2004 O.J. (L 46) 1.

165 *Id.* art. 1(1).

166 *Id.* art. 3(1).

167 Commission Regulation 300/2008, art. 1(1), 2008 O.J. (L 97), art. 1(1).

168 *Id.* art. 2(1).

areas.[169] There are additional criteria that can affect the scope of the rules, and these must also be considered, but it is again beyond the scope of this Article. This Regulation highlights a wider point in that the EU aviation rules center on aircraft transporting passengers and cargo between airports, so the conclusion here can have far-reaching consequences.

It is clear that aviation safety, security, consumer protection, and air service rules in the EU have a defined scope that consequently limits their applicability. The definition of "airport" is crucial in order to determine their scope. As a result, it must be asked whether a vertiport can be considered an airport. If yes, then the other criteria must be assessed to see if the regulations are applicable. If no, then vertiports are currently widely unregulated.

V. CONCLUSION

The EU has introduced the term "vertiport" into the language of UAM.[170] While the term has not yet been defined in law, EASA has given it a technical definition.[171] There are composite components of this definition that, when separated and explored, show there are key overlaps with existing terms to define aviation ground infrastructure, aerodromes, airports, and heliports. While EASA has tried to use the term "vertiport" to separate UAM ground infrastructure from traditional manned aviation ground infrastructure,[172] the separation is not as clear and absolute as may have been anticipated. Consequently, a vertiport may be deemed an aerodrome, airport, heliport, or some combination of all those components depending on the specific situation.

A consequence of this is that the rules that were drafted without consideration for UAM, such as the aviation rules on aerodrome safety, security, passenger protection, and air services, may be applicable to VTOL activities using vertiports. This may be a desirable but unintended consequence that ensures UAM activities are regulated. However, it may also be the case that these rules do not appropriately cover the specifics of UAM activities or that they are incompatible. For example, applying EU rules on delay for short distance, high frequency flying taxi ser-

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169 *Id.* art. 4.
170 *See, e.g.*, EUR. COMM'N, *supra* note 22.
171 EASA, *supra* note 32, at 18.
172 *See id.*

vices may be too onerous on this emerging market. As a result, the regulators will have to reevaluate the definition of "vertiport" before it enters into law, and assess the wider regulatory impact to ensure UAM activities are correctly regulated within the EU and Single European Sky.